

High Performance Multiphase Combustion Tool Using Level Set-Based Primary Atomization Coupled with Flamelet Models, Phase II

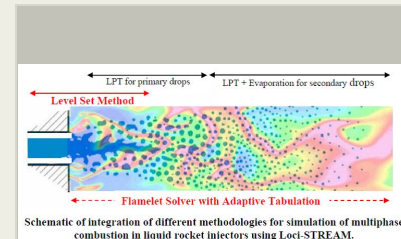
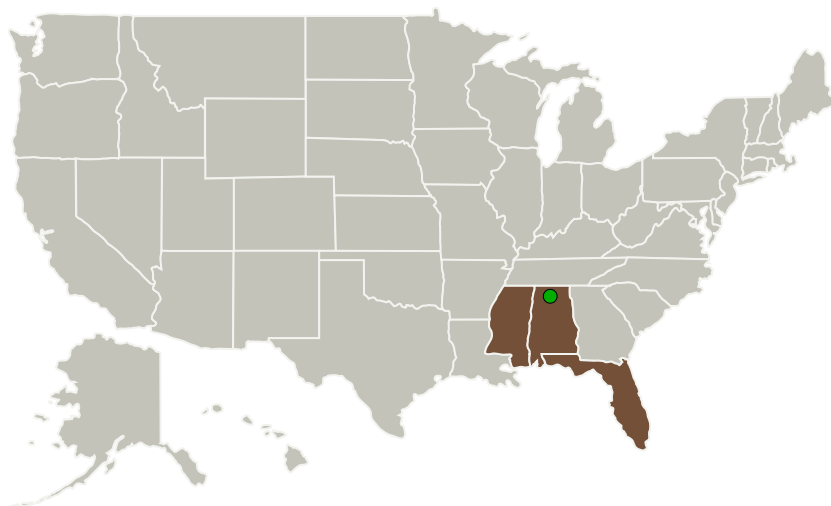
Completed Technology Project (2014 - 2016)



Project Introduction

The innovative methodologies proposed in this STTR Phase 2 project will enhance Loci-STREAM which is a high performance, high fidelity simulation tool already being used at NASA/MSFC for a variety of CFD applications. This project will address critical needs in order to enable fast and accurate simulations of liquid space propulsion systems of relevance to NASA's Space Launch System (SLS) program (LOX/RP-1 engines such as F-1 or potential replacement of RD-180, and LOX/LH2 engines such as RS-25, RS-25D/E, RL10, J-2X). The key methodologies which will be integrated into a production version of the Loci-STREAM code are the following: (a) Primary atomization modeling using Level Set methodology to model the liquid (core) jet, (b) Lagrangian particle tracking (LPT) for the droplets resulting from primary atomization, (c) Evaporation models for the droplets, (d) Flamelet models for turbulent combustion, (e) Adaptive tabulation for flamelet models, and (f) Hybrid RANS-LES (HRLES) methodology. Integration of the above methodologies into Loci-STREAM will result in a state-of-the-art multiphase combustion modeling tool which will enable fast and accurate design and analysis of liquid rocket engine flow environments, combustion stability analysis, etc. which constitute critical components of space propulsion engines that are part of NASA's SLS.

Primary U.S. Work Locations and Key Partners



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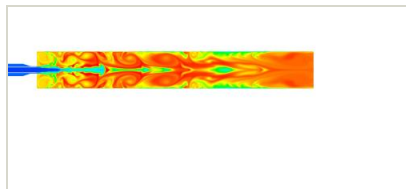


Organizations Performing Work	Role	Type	Location
Streamline Numerics, Inc.	Lead Organization	Industry	Gainesville, Florida
● Marshall Space Flight Center (MSFC)	Supporting Organization	NASA Center	Huntsville, Alabama

Primary U.S. Work Locations

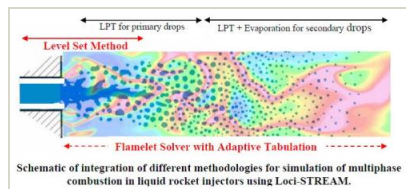
Alabama	Florida
Mississippi	

Images



Final Summary Chart Image

High Performance Multiphase Combustion Tool Using Level Set-Based Primary Atomization Coupled with Flamelet Models, Phase II Project Image
(<https://techport.nasa.gov/image/127982>)



Project Image

High Performance Multiphase Combustion Tool Using Level Set-Based Primary Atomization Coupled with Flamelet Models
(<https://techport.nasa.gov/image/128888>)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Streamline Numerics, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Siddharth S Thakur

Co-Investigator:

Siddharth Thakur

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Technology Maturity (TRL)

Start: 2
Current: 4
Estimated End: 4



Technology Areas

Primary:

- TX01 Propulsion Systems
 - └ TX01.1 Chemical Space Propulsion
 - └ TX01.1.3 Cryogenic

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System